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Summary and Analysis of Comments

On-highway Heavy-duty Vehicles and Engines

Introduction

EPA proposed and received comment on several provisions for on-highway heavy-duty vehicles and engines. The first portion of this section contains a summary and analysis of the comments received by EPA on the provisions that were finalized in the FIP final rule by EPA, including new engine standards and the engine recertification program. A number of the proposed requirements were not adopted by EPA in the final rule. For these provisions, comments are summarized and analyzed in detail only where the comments were relevant in light of EPA's decision not to adopt the proposals. Finally, a number of commenters offered suggestions for other ways of reducing emissions from on-highway heavy-duty vehicles. A summary and analysis of these comments is provided last.

Emission Standards

EPA proposed new emission standards for on-highway heavy-duty engines. The proposed emission standards were 1.5 grams per brake horsepower-hour (g/bhp-hr) NOx and 0.2 to 0.6 g/bhp-hr nonmethane hydrocarbons (NMHC). The majority of comments received dealt with the feasibility of meeting the proposed NOx standard. These comments are addressed in the preamble.

Engine manufacturers recognized that current HC emission levels were well below the standard of 1.2 g/bhp-hr. One manufacturer recommended a new standard of 0.6 g/bhp-hr, while

another manufacturer preferred to leave the standard unchanged out of concern for the feasibility of meeting the standard with lean-burn natural gas engines. The Southern California Gas Company argued that the NMHC standard should not go below 0.5 g/bhp-hr to accommodate natural gas engines.

EPA has determined from 1995 certification data that 84 percent of diesel engine families are certified to emit at or below a level of 0.4 g/bhp-hr throughout the useful life. Oxidation catalysts and fuel injectors with reduced sac volume are two technologies that will contribute to lower HC emission for those engines that need further improvement.

For gasoline-fueled engines, 30 percent of 1994 engine families emit 0.4 g/bhp-hr total hydrocarbon or less. MOBILE modeling assumes that 25 percent of hydrocarbon emissions from gasoline engines is methane. Decreasing certification emission levels by 25 percent to predict NMHC levels indicates that about 60 percent of engine families emit 0.4 g/bhp-hr total hydrocarbon or less. Further improvement could be gained from adjusting injection timing and optimizing catalyst design for oxidation of HC emissions. For example, adding a three-way catalyst with feedback control for the air-fuel ratio would reduce HC emissions.

One of the five natural gas engines certified for 1994 in California already meets the 0.4 g/bhp-hr NMHC emission level. Of the remaining four engines, the highest certified emission level is 0.9 g/bhp-hr, yet three of these engines are not equipped with catalysts. Catalysts specially formulated for natural gas engines can reduce NMHC emissions by well over 50 percent. EPA therefore

expects these engines to be capable of meeting the emission standards for the 2002 model year either through improved fuel management and better control of the combustion process, or at least through the use of catalysts.

One engine manufacturer requested optional certification using total HC measurement to comply with the NMHC standard. Also, a combined NMHC + NOx standard was preferred by some commenters. The Southern California Gas Company requested changing from an NMHC standard to a reactive organic gas (ROG) standard.

EPA believes that the request to conduct certification testing using a total hydrocarbon measurement is reasonable. Diesel exhaust contains virtually no methane, so a total hydrocarbon measurement should be the same as or slightly higher than an NMHC measurement. The Agency has decided in previous rulemakings to set separate HC and NOx emission standards, primarily because of the lack of information about the relative sensitivity of the two pollutants in ozone formation.

If EPA were to change the standard to a ROG standard, the level of the standard would need to be lowered in order to ensure the same level of control as is provided by the NMHC standard. For the FIP, EPA prefers to remain consistent with established federal and California heavy-duty engine standards which are not adjusted for reactivity.

Engine Recertification Program

(1) Introduction and Review of Proposal. EPA established the useful life (the period over which engine manufacturers are responsible for meeting emissions standards) for large heavy-duty

engines based on the average time before engines are rebuilt for the first time. Many heavy-duty engines (HDEs) are operated over mileages far exceeding the useful life specified when the engines are certified. This is due to the high replacement costs and overall durable engine designs. The engine life is often extended by one or more engine rebuilds. Therefore, the statutory useful life is only a small fraction of the actual operating life of the engine.

Diesel engine emissions standards have historically been met through fuel system and combustion chamber modifications. Many of these modifications also provided fuel economy, performance, and durability benefits. Because engine problems that caused a significant increase in emissions would very likely impact other areas of engine performance or durability, there was reason to believe that in-use emissions were controlled throughout the engine's actual life.

The very stringent NOx standard proposed in the FIP, however, would likely require the use of new technologies that act solely to reduce NOx. Because these new technologies would not offer engine performance benefits and could in some cases have performance penalties, operators would not have an incentive to maintain these emissions control technologies. With the manufacturer's liability expired and a lack of incentive to maintain the systems, EPA was concerned that the new emissions control technology would deteriorate after the end of the statutory useful life. EPA was also concerned that when the engine was rebuilt, the emissions controls would be removed.

EPA proposed a program (the engine rebuild program) to help ensure emissions control throughout the full life cycle of the vehicle. The proposed program would require that each engine subject to the new NOx standard either be within its original useful life or, at higher mileages, that the owner possess a valid useful life renewal certificate at time of vehicle registration. The useful life renewal certificate would be available from engine manufacturers and others that have been certified by EPA. Certification would require a demonstration that the engine would continue to meet the applicable emissions standards for the useful life renewal period. This demonstration required engine emissions testing beginning with an engine at the end of its useful life. The useful life renewal period would be set by the certifier. The certifier would also be required to provide a listing of all the maintenance items and other actions that would be performed at time of engine renewal in order to ensure that the emissions stayed below the applicable standards.

In the final rule, EPA changed the program name to the Engine Recertification Program because it better reflects the overall intent of the program. Because recent engine improvements increase the likelihood that engines will operate far past the statutory useful life without a rebuild, EPA anticipates that many useful life renewal certificates could be issued without the need for an engine rebuild. For example, it is possible that the recertifier would only replace a catalyst and run a check of other emissions controls such as exhaust gas recirculation system (EGR) before recertifying an engine. The certifier would determine the

maintenance items and procedures needed, including engine rebuilds, to ensure emissions control over the useful life renewal period. When engines were rebuilt, they would be required to be rebuilt to a configuration certified as meeting the applicable standards. This is described in detail below.

(2) Major Comment Areas. EPA received several comments from affected parties including engine manufacturers, truckers, and engine and parts rebuilders. The majority of comments were in the following areas: (i) need for the program, (ii) standardizing rebuilds, (iii) gasoline and smaller diesel heavy-duty engines and, (iv) certification requirements.

(i) Need for the program.

EPA received comments that the rebuild program is not needed because in-use heavy-duty engine NOx emissions levels are stable. Commenters noted that existing engine rebuild data indicates that engine rebuilding does not have a negative impact on emissions. Commenters did not believe that EPA should implement a complex and costly program based on speculation that engine rebuilding may cause emissions increases in the future. Some commenters suggested a thorough analysis be done and a program be implemented only if a problem is identified in the future.

EPA agrees that the data available suggests that older engine designs appear to have stable NOx emissions characteristics and that rebuilding does not appear to increase NOx significantly. Previous NOx standards have been achieved essentially through combustion chamber and engine modifications that are not prone to uncorrected deterioration, poor maintenance, or tampering. Often

these technology advances provided improvements in durability and fuel economy as well as NOx control.

However, the technologies and engine design changes used to meet future NOx standards will be much more sophisticated. EPA believes that some technologies that will be used to meet the 2.0 g/bhp-hr NOx standard will be added to the engine for the sole purpose of reducing NOx and that there would be little incentive to maintain such systems. EPA believes that the NOx standard being adopted will require the addition of emissions controls such as exhaust gas recirculation and NOx reduction catalysts to most of the engines sold in 2002 and the years immediately thereafter (see Section III.D.3.b. of the final rule Preamble).

These new emissions control technologies are important for emissions performance but are not integral to engine performance and therefore are vulnerable to poor maintenance. For example, there will be little incentive to replace a catalyst or EGR system that has failed after the end of the useful life period. Notwithstanding the anti-tampering prohibitions of the Clean Air Act, there would be an incentive to remove or incapacitate such systems for the majority of the engine's life cycle. There may also be a new incentive to rebuild engines to an engine configuration with higher NOx emissions. EPA believes that a program is needed to help ensure that such systems function properly throughout the life of the engine.

EPA believes that it is appropriate to adopt a program in the FIP final rule rather than waiting until a problem actually occurs. There is a clear need to ensure that emissions controls receive

necessary maintenance. Promulgating the program in a separate rulemaking and implementing it would likely take several years during which substantial program benefits would be lost. Furthermore, finalizing the program today may provide an incentive to manufacturers to develop more durable engine emission control designs and offer a longer original useful life as a marketing strategy.

(ii) Standardizing Rebuilds.

EPA proposed that certifiers provide a list of all actions such as repairs, parts replacements, and calibration checks that would be done to engines at the end of their useful life to ensure emissions performance over the useful life renewal period. EPA also proposed to require that certifiers supply a list of emissions related parts not being replaced along with the rationale as to why their replacement was unnecessary.

Engine manufacturers commented that current maintenance and rebuild practices are not standardized. The maintenance and component replacement needed to keep each engine in proper working order varies considerably. Commenters were concerned that the proposed program would require the same set of repairs and parts replacements to be performed on each engine. This would cause the unnecessary replacement of many components, greatly increasing the cost to the owner.

Also, preparing a list of all repairs needed at the end of the engine's useful life would require the examination of several engines at the end of their useful life in an attempt to minimize the number of unnecessary repairs on the list. This would delay

certification significantly, possibly leading to the lack of useful life renewal certificates when the first engines reach the end of their useful life. Commenters suggested allowing flexibility for certifiers to use reasonable and objective criteria to determine if and when repairs and engine rebuilds are necessary.

EPA believes that the commenters request for flexibility in this area is reasonable. EPA agrees that there should be flexibility to avoid parts replacements and engine rebuilding when those actions can be determined not to be necessary to ensure emissions control over the useful life renewal period. The key is being able to establish objective criteria that can be used to determine whether an action is necessary. For actions for which such criteria can be established, the certifier would submit the criteria during certification for EPA review. The application for certification would then include a list of actions that would always be done, a list of actions that may be done based on compliance with objective criteria, and a list of emissions related components not being replaced along with rationale as to why their replacement is not necessary.

Experience and engineering judgement should allow the above described list to be assembled. EPA expects that certifiers will be conservative and list all possible actions that could be necessary as engine reach the end of their useful life. Over time and with experience, certifiers would be able to identify items that could be removed from the list because they are unnecessary.

(iii) Gasoline and Smaller Diesel Heavy-duty Engines.

EPA received comment from the Engine Manufacturers Association

(EMA) that most heavy-duty engines do not greatly exceed their statutory useful life and are generally not rebuilt. EMA commented that it would be unreasonable to apply the rebuild program to this very large segment of the population while basing the need for the program on the characteristics of larger diesel engines.

EPA agrees that gasoline and smaller diesel heavy-duty engines are not usually rebuilt or used long past their useful life. EPA believes, however, that there is a benefit to including such vehicles in this program. The limited information available suggests that gasoline heavy-duty engines and lighter heavy-duty diesel engines are generally used for up to two times their useful life. Again, the loss of NOx control for up to half their full life would add up to a significant loss of benefits attributed to the tighter standard.

Under this program, owners that opt to use their vehicles longer than the engines' useful life would likely be able to secure a useful life renewal certificate with minimal engine repair. More likely, an inspection, and repair or replacement of emissions control components such as EGR or a NOx reduction catalyst would be required in order to secure a useful life renewal certificate that matches owner needs. EPA believes that such a check and repair of the emissions control systems would be an effective approach to complying with this program. Alternatively, the program may provide an incentive for manufacturers to provide a longer original useful life, allowing more owners to use their vehicle for the vehicle's life cycle without having to recertify the engine.

(iv) Certification Requirements.

EPA received comment that engine manufacturers should be allowed to rely on the existing new engine certification data when an engine is being rebuilt to its certified new engine condition. Another test of the same exact engine configuration would be redundant. Commenters recommended that, where new engine certification data exists for an engine configuration, a simplified certification process which does not require further engine testing would be adequate.

EPA agrees that, in theory, an engine restored to a condition identical to its new condition should have emissions characteristics matching those of the new engine. However, in practice, the only way to assure this is to replace the used engine with a new one. Realistically, the requirements of this program will result in engines and emissions control systems consisting of both old parts and new parts. Without testing, there is no assurance of durable emissions performance. There are too many uncertainties at this time to allow the use of new engine certification test data.

EPA also received comment that the proposed requirement to perform certification testing using an engine at the end of its useful life would be very disruptive. This requirement, commenters believe, would delay useful life renewal certification testing until the first engines reached the end of their useful life. Because certification would be time consuming, there would be no useful life renewal certificates available to vehicle owners for a long period of time forcing them to cease vehicle operation.

EPA agrees that obtaining engines at the end of their useful

life for certification testing represents a significant challenge to potential certifiers. However, EPA continues to believe that it is necessary to conduct certification testing with an engine at or beyond its useful life. EPA needs assurance that in-use engines are maintaining emissions control. EPA's proposed approach is the best currently available method for assuring that the combination of old and new components that results from the repairs done at the end of the useful life will meet program requirements. EPA believes that through accelerated aging of engines or by using the engines used in original durability testing, engine manufacturers and other certifiers could certify before engines begin reaching the end of their useful life.

Some commenters were concerned that fleets and independent garages currently rebuilding engines and components would in effect be prohibited from performing these functions because the certification requirements were too costly. The result would be a very limited number of rebuilders, reducing the supply of rebuilt engines and components and greatly increasing costs.

EPA recognizes that the certification testing requirements in general represent a significant requirement for possible certifiers and have the potential to cause some disruption. In the proposal, EPA requested comments on how to make certification testing less burdensome. However, at this time EPA does not have enough data to support eliminating or modifying the certification testing requirements. EPA must retain the requirements proposed, as they currently are the only available way to help ensure engines will meet applicable standards throughout their life cycle.

EPA would work with affected parties to develop other less costly methods for certification testing that still provide the needed assurances of emissions control. EPA could also consider other approaches that would reduce costs such as allowing testing information to be used by more than one certifier, assuming each certifier were willing and able to follow the certified procedures and accept liability.

(3) Other Comments.

Commenters noted that most engines are used well past 290,000 miles before needing to be rebuilt, sometimes even exceeding one million miles before rebuild. They commented that requiring engines to be rebuilt at 290,000 miles would be very expensive and wasteful.

EPA would require recertification at the end of the statutory life, which is 290,000 miles or 10 years for the largest diesel engines (engine manufacturers may offer a longer useful life). Recertification would be required at the end of the useful life because it is at this point that the original engine manufacturer is no longer responsible for the emissions performance of the engine. Emissions control components such as a catalyst would be designed to last for the useful life but not necessarily past the end of the useful life.

As described above, the recertifier would determine what is needed to ensure continued compliance with emissions standards after the original useful life. The recertifier would then replace the original engine manufacturer as the party responsible for the emissions performance of the engine. The market would determine

the least cost method of recertifying engines. If an engine rebuild is not needed to ensure emissions performance, then there will very likely be a recertifier willing to recertify the engine without first rebuilding it.

One commenter suggested that EPA should focus on certifying parts. Engine manufacturers similarly commented that non original equipment manufacturer (non-OEM) aftermarket parts are currently used that do not match the original parts and that the effect of those parts on emissions is not known. In response, because emissions performance depends not only on what parts are installed but how and when they are installed and other factors as well, EPA believes that it is best to focus on the recertifier. This allows EPA to hold a single party responsible for the emissions performance of the engine. The recertifier may authorize parts to be installed by someone else but the recertifier would remain ultimately responsible.

EPA received one comment that the vehicle owner should not bear the full burden of responsibility if a vehicle is found to be out of compliance even though the owner has followed the regulations. In response, EPA proposed to hold the engine recertifier responsible for emissions noncompliance during the useful life renewal period. The owner would be responsible only for obtaining and holding a valid useful life renewal certificate at all times after the end of the original useful life.

Some commenters seemed to misunderstand the applicability and scope of the requirements, commenting about the effects of the program on pre-1999 engines. EPA received comment that the rebuild

provisions requiring that engines be upgraded to current year emissions standards was not possible and would result in a defacto prohibition on engine rebuild. The commenter continued by stating that the requirement would result in the loss of tens of thousands of jobs due to the complete elimination of in-house maintenance facilities and independent garages.

EPA did not propose any rebuild or upgrade requirements for pre-1999 model year engines. Similarly, the final program as specified in the Preamble would not affect any pre-2002 model year engines or require engines to be rebuilt to an emission level below the level to which they were originally certified. Retrofitting or upgrading older engines to make them cleaner may be attractive as an option in some cases (see the "Miscellaneous Comments" section below). However, EPA understands that such improvements do not currently appear to be achievable for a number of engines and therefore did not propose such requirements.

As discussed above, EPA is interested in working toward developing less costly approaches for engine recertification. Because the program is designed to ensure that maintenance essential to the emissions performance of the engine is performed when needed, EPA would expect no decrease in maintenance activities due to the program. Therefore, EPA does not agree that substantial job losses should be expected overall due to the program requirements.

I/M Program

In the proposal, EPA proposed a limited I/M program for heavy-duty vehicles. Specifically, EPA proposed to subject to enhanced

I/M all pre-1999 gasoline-fueled heavy-duty vehicles less than 19,500 pounds GVWR. Such vehicles are currently covered by California I/M programs utilizing idle test procedures. EPA requested comment on including heavy-duty vehicles up to 26,000 pounds GVWR in an I/M program as an alternative to the evap-free and engine recertification requirements.

Some commenters supported EPA's use of I/M testing for heavy-duty vehicles. Diesel engine manufacturers expressed support for I/M programs in general, but noted that for NOx and HC control major work would be needed to develop a test cycle and correlate it to the engine certification test. Detroit Diesel Corporation commented that poor maintenance which causes NOx emissions to increase would also cause performance degradation and therefore is not likely to occur. EPA received no comments on I/M testing requirements specifically for gasoline-fueled vehicles.

EPA continues to believe the requirement for full enhanced I/M testing for all gasoline-fueled heavy-duty vehicles up to 19,500 pounds GVWR is appropriate. EPA also believes that in the absence of the evap-free requirement, it is appropriate to require gasoline-fueled heavy-duty vehicles of all sizes to pass the evaporative portion of enhanced I/M testing. EPA expects that the recertification program will provide sufficient assurance of exhaust emission control for vehicles above 19,500 pound GVWR. A heavy-duty vehicle of any size or model year certified to meet evap-free provisions would be exempted from the I/M requirements for evaporative testing.

Recall Program

EPA proposed an enhanced recall program for light-duty vehicles and heavy-duty engines. EPA proposed to test engines in the condition in which they are received from the owners, with vehicles being removed from the sample only if they had been subject to obvious tampering or abuse. EPA also proposed to test engines over their full useful life. Currently, engines would be tested only in proper operating condition. As a matter of policy (as opposed to regulation), EPA does not currently select engines for recall testing that are past 75 percent of their useful life (48 FR 52170, November 16, 1983).

Engine manufacturers strongly objected to the proposals. EMA commented that the engine manufacturers could not ensure proper fueling and maintenance and could not design engines to withstand the effects of misfueling and poor maintenance. EMA noted that a heavy-duty engine recall test sample is very small and that one poorly maintained or tampered with engine could have a significant effect on the outcome. EMA suggested that the owner should bear the responsibility for proper fueling and maintenance and that an I/M test would be an appropriate tool for enforcement. EMA also opposed the testing of engines past 75 percent of their useful life, commenting that the useful life is an average of when engines wear out. Some engines are expected to meet emissions standards beyond the useful life and some are expected to wear out before the end of the useful life.

EPA continues to believe that there may be ways of manufacturing engines that are more tamper resistant and that better withstand the effects of poor maintenance. EPA also

continues to believe that testing throughout the engines' full useful life would be consistent with the effort to promote continuous emissions control and the engine recertification program. However, due to the uncertainties in this area and the seriousness of the objections to its proposals, EPA does not believe that it is appropriate to change the recall program.

Multiple State High Emitting Engines

EPA was concerned that trucks registered in another state but operating at least part of the time in California would not be subject to the very tight California NOx standard. EPA was also concerned that the cost impact of the proposed California NOx standard would cause trucks that would normally be registered in California to be purchased and registered in another state. Though registered in another state, these trucks would probably still have significant operation in California. Such practices would cause a substantial loss of emissions benefits in the three FIP areas. To address these concerns, EPA proposed that interstate trucks operating in California either be part of the fleet averaging program or be subject to usage restrictions.

EPA no longer believes that a shift in registration practices is likely or that average emissions levels of interstate and within-state trucks will differ significantly. As described in Section III.D.3.b. of the Preamble, EPA is adopting a 2.0 g/bhp-hr standard beginning in 2002 and intends to make the national standard consistent with the California standard soon thereafter. The 2.0 g/bhp-hr standard is not likely to create a great long-term economic incentive to shift vehicle registration practices to

another state. With the harmonization of the national and California standards, EPA no longer believes interstate provisions are necessary.

EPA received several, mostly critical comments to these proposals. The proposals were strongly opposed by truckers. A detailed summary of and response to these comments is not necessary because the interstate trucking requirements were not included in the final rule for the reasons described above.

Fleet Averaging Program

The benefits achieved in the near term from a new NOx standard depend on the turnover of old vehicles to new vehicles meeting the more stringent new emission standard. EPA was concerned that turnover of the fleet would begin to lag historical turnover rates due to the increased cost of vehicles and the possible need for alternative fuels. A dramatic decrease in vehicle turnover rates could substantially reduce the benefit of the new standard at least in the time frame of complying with requirements to demonstrate air quality attainment.

Because the contribution of HDEs to attainment was projected assuming normal vehicle turnover, EPA believed that it was important to have a program that encouraged vehicle turnover at historical rates. To encourage fleet turnover, EPA proposed the fleet averaging program. The program required vehicle fleets to meet a declining average NOx emissions level each year or pay a surcharge based on the tons per year of NOx that were being emitted due to not meeting the target.

EPA no longer believes that a significant long-term lag in

vehicle turnover is likely. Diesel engines meeting the new standard are expected to be available and, although they will likely be more expensive than current engines, the change in cost is not expected to have a long-term impact on purchasing practices. EPA therefore did not adopt the fleet averaging program for on-highway heavy-duty vehicles in the final rule (see Preamble section III.D.3.g.).

The majority of commenters opposed the Fleet Averaging Program proposal. Many commented that the surcharge calculation was unfair because it did not take vehicle usage into account. Also, several commenters offered suggestions on ways to improve the program to make it more reasonable. A detailed summary and response of these comments is not necessary because the fleet averaging program was not included in the final rule for the reasons described in this section.

In the proposal for the fleet averaging program, EPA requested comment on a sales mandate that would require heavy-duty engine manufacturers to sell a specific number of engines meeting the FIP standards. EPA received several comments strongly opposing such a mandate. Because there was little support for a sales mandate and much less need for such a requirement given the standards being adopted for California and planned nationally, EPA does not believe that a sales mandate would be appropriate.

Miscellaneous Comments

Throughout the FIP proposal, EPA requested comments on other ways of achieving emissions reductions. Some commenters suggested averaging approaches similar to the stationary source RECLAIM

Program. One commenter suggested a "freight bubble" that would include trains, trucks, and ships. Under such a bubble emission reductions would be required from these sources as a whole rather than from each individual source. Many commenters were interested in an averaging scheme that would give credit for reducing emissions from the in-use truck fleet through the use of such items as vehicle scrappage, speed limit enforcement, vehicle retrofits, idling restriction, the use of alternative fuels, and the purchase of 4.0 g/bhp-hr engines before 1998. The commenters suggested that such an averaging program would replace the need for extremely stringent new engine standards such as those proposed.

In response, EPA supports the development and use of more flexible approaches and believes that such programs have potential for reducing the costs of emissions control. EPA believes however, that such programs would need to be developed in close cooperation with all parties concerned (e.g., truckers, equipment and engine manufacturers, state and local governments). The time needed for such a development effort was not available for the FIP. EPA also believes that such programs would need to be developed and implemented on a state and local level as opposed to in the FIP due to the complexities inherent to the implementation and enforcement of such programs.